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ABSTRACT

In this study a program for using computers in science classrooms was developed and implemented in a preservice training course for secondary biology teachers (N=31; 8 males and 23 females) in Israel. The effects on student teachers' attitudes were investigated. The program included a sequence of activities in which student teachers became acquainted with the use of relevant software in their subject matter and critically discussed how to intergrate the computer assisted instruction (CAI) into an existing curriculum in their science classrooms. Data obtained in a post-test attitudes questionnaire were compared with the pre-test data and analyzed with a t-test. Student teachers' attitudes became significantly more positive toward the use of CAI in high school curricula in each of the questionnaire's four factors: (1) teaching strategies; (2) understanding science; (3) classroom learning environment; and (4) students' self-esteem. The student teacher questionnaire is appended. (KR)

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Training Student-Teachers in the Use of Computers in Science Classrooms

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Training Student Teachers in the Use of Computers in Science Classrooms : Course Description and Student- Teachers' Attitudes

INTRODUCTION

The efficient use of the computer in the classroom is heavily dependent upon the positive approach of the teacher toward the use of the computer (Atkinson M.L., 1984).

One way of creating positive attitudes of the future teachers toward the computer is through an appropriate training program. That would give the teachers self-confidence in operating a computer and a broad knowledge of the various ways teachers can use computing in their instructional programs.

In planning a pre-service course aimed to train science student- teachers in the use of computer assisted instruction (CAI) as a part of an existing curriculum, we assumed that several factors should be considered:

1.The target population of the course are student- teachers, who are expected to use the computer in different subject matter and in heterogenous classrooms. One may assume that these teachers will not be expected to teach computer science or programming; therefore ,the course will not include computer languages or computer technical knowledge .

2. Computer literacy , as such, will not be included in the course's topics but only in connection with a relevant use of computers in the learning process.

3.The use of a computer in a classroom demands different classroom management skills than those used in a regular classroom. Topics as such dealing with classroom- management should be included in the syllabus of a pre-service teachers' course.

Formative evaluation of an in-service training course held in order to encourage science teachers in the use of computers found that role playing and small group interaction helped teachers " to overcome their reluctance to use computers and to plan for their effective implementation in the school".

THE STUDY

In this study we decided to develop and to implement a training course for pre-service teachers as to how to use CAI in high school science classrooms and to investigate student-teachers' attitudes toward the use of a CAI approach. These attitudes can be considered as a pre-requisite for teachers' readiness to use the computer and to master the necessary skills. It was assumed that student-teachers' attitudes may provide the information needed for constructing an efficient program on training pre-service and in-service science teachers on CAI use.

METHODS

The population in this study were 31 student-teachers (8 males and 23 females) in a pre-service training course for secondary teachers. They studied toward a BSc degree in Biology and a Certificate of Teaching for Junior and Senior High School in a four years program. During the four years program they simultaneously studied biological sciences and educational courses . The course "Using Computers in Science Classroom " was offered in their third year of studies.

THE COURSE DESIGN

The course "Using Computers in Science Classroom " is one of the elective courses in the pre-service training program toward receiving the Certificate of Teaching.

The duration of the course was 15 weeks, two hour per week,thus total of 30 hours of training.

The components of the training student- teachers' course on using the computer in science classrooms included the following activities:

1. Introduction into the use of various computerized activities,such as drill and practise,tutorial, games, simulations and graphics by active experience.
2. Instruction in how to integrate the different computerized activities into a curriculum sequence.
3. The use of generic software, such as data base and electronic spreadsheet.
4. The use of the computer in different teaching and learning settings, such as frontal approach, group and individualized instruction.
5. The clarification of classroom management problems while CAI is used.

The goals of this course were to enable the students'-teachers to correctly use the various software in science teaching and to be aware of computer educational concepts and management principles relating to the various instructional applications , such as 'drill and practise' ,tutorial, simulations, games,data base etc.

During the course the students were acquainted with the various software types , through active experience and their evaluation.

Research papers dealing with the use of computers in science teaching and learning were important learning tasks and were discussed during the course.

A DESCRIPTION OF A SEQUENCE OF SESSIONS

Step one

At the begining of a session a new type of software was introduced by the instructor, such as a tutorial program in a specific biology subject.

The instructor emphasized the nature of an efficient tutorial program to branch, to offer students remedial treatment and to give opportunities for enrichment learning.

Then a discussion followed as how to use the software program in the existing biology curricullum. Based on the above points a list of criteria on evaluating a software was developed.

Step Two

Then a tutorial program in Biology "Synapse" (Huppert, 1987) was presented to the student -teachers on a large television screen. This program introduced the synapsis knob using text, graphics and animations.

This software demonstrates the influence of various drugs on the synaptic transmission. The introductory part of the software dealt with the structure of a neuron and with the structure of a synapse .

Three different influences of a drug on the transmission of a nerve signal through a synapse cleft is demonstrated:

a) a poison which prevent acetylcholin from reaching the motor end plate (curare),

b) a poison which cause the enzyme acetycholin-esterase to be non-active (nerve gas), and

c) a poison which prevent the release of the transmitter acetylcholin (butulin toxin) .

A computerized self- assesment achievement test followed the tutorial program.

Step Three

At the next stage the students were asked to work in pairs or alone on the Synapse program. Students were asked to evaluate the software using a list of criteria, as developed in step 1.

Step four

Students were required to evaluate various software programes by using an " Evaluation Sheet", which had been based on the NSTS " Microcomputer software evaluation instrument" (1985).The evaluation report was focused on 3 main topics : a) Science subject - matter standards, b) Instructional qualities and c) Technical qualities of the software program.

Step five

A class discussion was held on the following points:

a) The values of the the instructional design, and the application of science processes in the software .

b) The change in the teachers' role in the classroom ,while using this type of tutorial software was discussed. In this situation the teacher is acting more as a tutor and not as a source of information, since all the necessary information is presented in the software program.

c) Students activities, while working with the computer were analyzed and discussed.

d) The various ways of integrating this specific software into an existing curriculum were presented. For instance, the use of the software as a part in a sequence of other learning activities or as an extention or concluding activity of the specific topic studied in the classroom.

RESEARCH PROCEDURE

At the end of the training course of using computers, an attitude questionnaire was administered to the student-teachers in order to asses their attitudes toward the use of CAI in science classroom.(See Appendix A) The questionnaire included twenty items clustered into four factors: 1) Teaching strategies (6 items) , 2) Understanding science (3 items), 3) Classroom learning environment(6 items), and 4) Students' self esteem (5 items).

RESULTS

Students attitudes toward the use of CAI in science classrooms were assessed as a pre-test before the course started and as a post-test at the end. Students' mean scores on the items were analyzed for the four factors

by a t-test and are presented with their standard deviations and t- test values in Table I.

Table I.

Students' mean scores ,standard deviations and t-test values of the four factors on the attitude questionnaire

Factors	Pre-test X (SD)	Post-test X (SD)	t-test	P
Teaching strategies	2.82 (.79)	2.97 (.80)	2.09	.01
Understanding science	2.18 (.86)	2.38 (1.00)	2.07	.01
Classroom learning environment	2.65 (.73)	2.78 (.80)	1.87	.02
Students' self-esteem	2.88 (.76)	3.08 (.72)	2.63	.00

As can be seen from the results , student-teachers' attitudes become significantly more positive toward the use of CAI in existing high school science curricula in all the four factors. According to their attitudes ,the integration of CAI can help teachers in their teaching strategies, it can help in developing a better picture of what science means, it may change the classroom learning environment to a more positive climate and finally, it improved their self- esteem.

It is of interest to mention what students said at the end of the course : Most of the students felt much more comfortable using the various software in a biology lesson ; they expressed their belief that the teacher's part in a CAI situation is most important ,inspite of the new role this learning situation created and all the students encouraged us to hold similar courses in the future.

DISCUSSION

The main issue of the inservice course " Using Computers in Science Classroom" was what should be the real role of computers in high school science in general and biology in particular.

It is known that computers can be used for text and test reading, games, tutorial ,drill and practice and simulation of laboratory experiments. In our opinion CAI can play an important role in classrooms and laboratory work not as a substitute for other activities but as an additional tool.

Therefore, in the course we emphasized the importance of the teachers instruction and presence in the classroom and laboratory, the importance of using text-books and having students "hands on " in real experiments together with the use of a computer program. Our approach is that the use of computer in the classroom is not merely a technical addition to education but one which provides a sophisticated tool to enhance the reasoning level of the student .

This approach stimulated us in designing our course and may have helped us in communicating to our student-teachers the message that teachers' role is more important then the computer which is only a technical tool. It is our belief that this approach helped student-teachers to overcome their hesitations and inhibitions.

Finally the students were asked to suggest where and how to integrate the software at the relevant topics in the existing curriculum.

It is our belief that only active participation of student-teachers in their training and taking into consideration their professional developmental stages, one can help in the introduction of new educational techniques , new technologies or teaching new strategies in the classroom.

The results of the attitude questionaire support our approach ,since one can see that following the course student - teacher changed their attitudes in a more positive manner toward all the four factors asked in the attitude questionaire.

The results show that the strategy used in our course encourage teachers in the use of computers in the science classroom.

Appendix A

Student- teachers attitude questionaire
about computer use in the high school science classroom.
(clustered into four factors)

Factor A: Teaching Strategies

1.The integrated use of CAI in the learning process enables the learner to use a more flexible way to work on his assignmnets.
2. I don't know how to integrate the computer in my teaching.
3. The use of CAI is a time-consuming procedure.
4. Teachers' explanations are better then those offered in the microcomputer.
5. Learning with CAI enables students to learn more in a given time.
6. Computer assisted instruction enables students' self pace learning.

Factor B: Understanding Science

7. Performing experiments in the laboratory is an important part in science learning, rather then microcomputer simulations.
8. Students understand better the nature of the research in science while performing experiments in the laboratory.
9. Learning science with CAI produces negative approach toward science subjects.

Factor C : Learning Environment

10.Studying in a computer assisted instruction environment inhibits students interaction.
11.When learning by CAI the teacher is unable to cotrol the students' pace of progress.
12. The computer assisted instruction inhibits teacher-students interaction.
13. Learning with computer assistance hinders students' competitivenes
14. By learning in a CAI setting ,students do not feel the need to consult the teacher.
15. Learning in a CAI setting gives too much freedom to students in the classroom.

Factor D : Students' self esteem

16. Students' achievements are higher when learning with microcomputer assistance.
17. Computer assisted instruction enables students' self expression and open mindedness.

18. Learning by CAI the students develop self-confidence.
19. Computer assisted instruction helps students to develop independent thinking.
20. Learning with computer assistance instruction , increases the students willingness to accept new ideas.